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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/713,023	11/17/2003	Kazuhisa Takagi	402874	9731
23548	7590	04/25/2005		
LEYDIG VOIT & MAYER, LTD 700 THIRTEENTH ST. NW SUITE 300 WASHINGTON, DC 20005-3960			EXAMINER DUPUIS, DEREK L	
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DATE MAILED: 04/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/713,023	Applicant(s) TAKAGI, KAZUHISA	
	Examiner Derek L. Dupuis	Art Unit 2883	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☒ Claim(s) 2-8 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>11/17/2003</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 11/17/2003 has been considered by the examiner.

Specification

3. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.
4. The disclosure is objected to because of the following informalities: the phrase "waveguide bending and" in line 24 of page 2 should apparently be "waveguide bending loss and" so as to correspond with figure 6. The sentence beginning on line 14 of page 4 and ending on line 16 of the same page reads improperly. The phrase "a optical loss" in line 7 of page 6 should apparently be "an optical loss". Appropriate correction is required.

Claim Objections

5. Claims 2-8 objected to because of the following informalities: the word "Claim" should be written in lowercase so as to read "claim". Appropriate correction is required.
6. Claim 3 objected to because of the following informalities: the limitation "comprises multi mode interference coupler" should apparently be "comprises a multi mode interference coupler". Appropriate correction is required.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 1, 4, 5, 7, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Toshiya (JP 3256028)* and further in view of *Furuyama (US 6,741,781)*.

9. Regarding claim 1, Toshiya teaches a semiconductor optical waveguide device as shown in figure 1. The device includes a semiconductor substrate (10) in which a plurality of S-shaped bent waveguides (11, 12, and 13) are embedded. There are at least two optical waveguide returning parts (14 and 15) with multiplexing portions interposed between an input end (1) and an output end (2) of the bent waveguides. Each optical waveguide returning portion (14 and 15) also includes a light reflecting part (16 and 17) on the rear side of the multiplexing portion. Toshiya does not teach that the reflecting part (16 and 17) is inside of the semiconductor substrate. Rather, Toshiya teaches that the reflecting parts (16 and 17) are located on a cleaved end of the substrate as is shown in figure 1. Furuyama teaches an semiconductor optical waveguide device as shown in figures 17 and 18 with a light reflective portion (3) formed inside of a semiconductor substrate (1).

10. Regarding claim 4, Toshiya in view of Furuyama teach a semiconductor optical waveguide device as discussed above in reference to claim 1. Toshiya teaches that the optical waveguide returning parts (14 and 15) are directional couplers (see abstract).

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11. Regarding claim 5, Toshiya in view of Furuyama teach a semiconductor optical waveguide device as discussed above in reference to claim 1. Furuyama teaches in figures 17 and 18 that the optical waveguide returning parts and the light reflecting parts (3) are buried in the semiconductor substrate at a desired depth.

12. Regarding claims 7 and 8, Toshiya in view of Furuyama teach a semiconductor optical waveguide device as discussed above in reference to claim 1. Furuyama teaches that a reflecting film comprising a metal such as aluminum can be deposited by vapor deposition (see column 13, lines 5-14). Furuyama teaches that the reflecting mirror totally reflects an optical signal which is greater than 30% reflectance (see column 16, line 56 to column 17, line 30).

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the device of Toshiya by rearranging the device to include the light reflective portion on the inside of the semiconductor substrate as taught by Furuyama since it has been held that rearranging parts of an invention involves only routine skill in the art. In re Japikse, 86 USPQ 70. Further motivation to do this would be to reduce the loss by coupling the two waveguides away from a cleaved end where light could escape.

13. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Toshiya (JP 3256028)* and further in view of *Furuyama (US 6,741,781)* as applied to claims 1, 4, 5, 7, and 8 above, and further in view of *Soldano et al (NPL)*.

14. Regarding claims 2 and 3, Toshiya in view of Furuyama teach a semiconductor optical device as discussed above in reference to claim 6. Toshiya teaches the use of a directional coupler as a waveguide returning part. Neither Toshiya nor Furuyama teach that the waveguide returning parts comprise Y-branch couplers or MMI couplers. Soldano et al teach that MMI

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couplers and Y-branch couplers perform similar functions of direction couplers (see section VIII).

It would have been obvious to one of ordinary skill in the art at the time of invention to replace the directional coupler in the semiconductor optical waveguide device of Toshiya in view of Furuyama with an MMI coupler or a Y-branch coupler. Motivation to do this would be that an MMI device has low loss and good balancing and because a Y-branch coupler has large bandwidth (see section VIII and table III).

15. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Toshiya (JP 3256028)* and further in view of *Furuyama (US 6,741,781)* as applied to claims 1, 4, 5, 7, and 8 above, and further in view of applicant's own admission of prior art.

16. Regarding claim 6, Toshiya in view of Furuyama teach a semiconductor optical device as discussed above in reference to claim 1. Neither Toshiya nor Furuyama teach that the bent waveguides include a core layer made of a InGaAsP material and a cladding layer made of an InP material or that a light at a wavelength of 1550 nm is applied to the device or that the waveguides are bent with a radius of curvature of at least 2400 μm . Applicant's admission of prior art (Figures 5A and 5B) show a InGaAsP core layer (12) and a p-type InP cladding layer (13). While Toshiya and Furuyama do not teach that the incident light has a wavelength of 1550 nm, it is common practice in the art to use light of this wavelength.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify semiconductor optical device admitted by applicant as prior art by adding a plurality of S-shaped bent waveguides and optical waveguide returning parts with light reflecting portions as

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taught by Toshiya in view of Furuyama. Motivation to do this would be for the purpose of miniaturizing the device (see abstract of Toshiya).

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the bent waveguides of the device taught by Toshiya in view of Furuyama and in further view of applicant's admission of prior art by setting the radius of curvature of the waveguides to at least 2400 μm since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

17. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's own admission of prior art in view of *Blauvelt et al (US 2003/0081902 A1)* and in further view of *Toshiya (JP 3256028)*.

18. Regarding claim 9, applicant's admission of prior art in figures 5A and 5B show a waveguide with a core layer (12) formed on an upper surface of a semiconductor substrate (11) and a cladding layer (13) formed on the core layer. However, figures 5A and 5B do not show that the waveguide is formed as a ridge of the semiconductor substrate. However, Belauvelt et al teach in figures 26-33 that it is well known in the art to form a waveguide as a ridge of a semiconductor substrate.

Neither the applicant's admitted prior art nor Belauvelt et al teach incorporating s-shaped bent waveguides with optical returning parts including light reflective parts. Toshiya teaches a semiconductor optical waveguide device as shown in figure 1. The device includes a semiconductor substrate (10) in which a plurality of S-shaped bent waveguides (11, 12, and 13) are embedded. There are at least two optical waveguide returning parts (14 and 15) with

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multiplexing portions interposed between an input end (1) and an output end (2) of the bent waveguides. Each optical waveguide returning portion (14 and 15) also includes a light reflecting part (16 and 17) on the rear side of the multiplexing portion.

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the semiconductor optical waveguide device of the admitted prior art by forming the waveguide as a ridge of the semiconductor substrate as taught by Belauvelt et al. Motivation to do this would be to result in easy coupling of the waveguide with optical fibers, other waveguides, and other optical devices as is shown in the figures (see figures 26-33).

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the semiconductor optical waveguide device of the admitted prior art in view of Belauvelt et al by incorporating the s-shaped waveguides and the waveguide returning parts with reflective portions as taught by Toshiya. Motivation to do this would be for the purpose of miniaturizing the device (see abstract of Toshiya).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Derek L. Dupuis whose telephone number is (571) 272-3101. The examiner can normally be reached on Monday - Friday 8:30am-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank G. Font can be reached on (571) 272-2415. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Derek L. Dupuis
Group Art Unit 2883



Frank G. Font
Supervisory Patent Examiner
Technology Center 2800